PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2003-229275

(43)Date of publication of application : 15.08.2003

(51)Int.Cl. H05B 33/14
H05B 33/22
// C09K 11/06

(21)Application number : 2002-341774

(22)Date of filing : 26.11.2002

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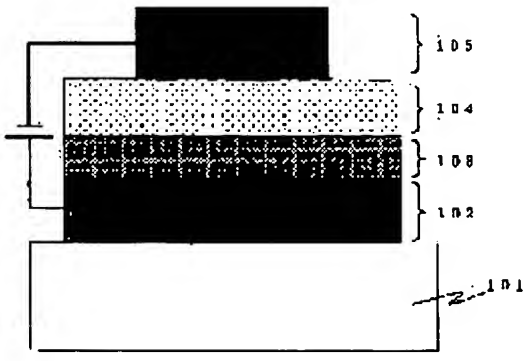
(30)Priority

Priority number : 2001360500 Priority date : 27.11.2001 Priority country : JP

(54) LIGHT EMITTING ELEMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a triplet light emitting element made to have high efficiency and stability by simplifying the element structure without using unstable material, capable of saving labour for manufacturing in comparison with previous elements. SOLUTION: For the element structure not using a hole blocking layer introduced to the previous triplet light emitting elements, laminating a positive electrode 102 on a base plate 101; a hole carrier layer 103 made of hole carrier material on the positive electrode; and a light emitting layer 104 having electron carry property made of electron carrier material and triplet light emitting dopant material, and a negative electrode 105 on the hole carrier layer; the combination of the hole carrier material and the electron carrier material and the combination of the electron carrier material and the dopant material are optimized.



LEGAL STATUS

[Date of request for examination]	26.11.2002
[Date of sending the examiner's decision of rejection]	31.05.2005
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	3759925
[Date of registration]	13.01.2006
[Number of appeal against examiner's decision of rejection]	2005-12311
[Date of requesting appeal against examiner's decision of rejection]	30.06.2005
[Date of extinction of right]	

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CLAIMS

[Claim(s)]
[Claim 1] an anode plate, the organic compound film, and cathode -- since -- the light emitting device characterized by to be added the luminescent material which presents luminescence from a triplet excitation state in said electronic transportation layer in the organic light emitting device constituted, including the electron hole transportation layer which said organic compound film becomes from an electron hole transportation ingredient, and the electronic transportation layer which consists of an electronic transportation ingredient prepared in contact with said electron hole transportation layer.

[Claim 2] an anode plate, the organic compound film, and cathode -- since -- the light emitting device characterized by to be added the luminescent material which presents luminescence from a triplet excitation state in said electronic transportation layer in the organic light emitting device constituted, including the hole injection layer with which said organic compound film was prepared in contact with said anode plate, the electron hole transportation layer which consist of an electron hole transportation ingredient, and the electronic transportation layer which consist of an electronic transportation ingredient prepared in contact with said electron hole transportation layer.

[Claim 3] an anode plate, the organic compound film, and cathode -- since -- the light emitting device characterized by to be added the luminescent material which presents luminescence from a triplet excitation state in said electronic transportation layer in the organic light emitting device constituted, including the electron hole transportation layer which said organic compound film becomes from an electron hole transportation ingredient, the electronic transportation layer which consist of an electronic transportation ingredient prepared in contact with said electron hole transportation ingredient, and the electronic injection layer which were formed in contact with said cathode.

[Claim 4] In the organic light emitting device constituted an anode plate, the organic compound film, and cathode -- since -- said organic compound film The hole injection layer formed in contact with said anode plate, and the electron hole transportation layer which consists of an electron hole transportation ingredient, The light emitting device characterized by adding the luminescent material which presents luminescence from a triplet excitation state in said electronic transportation layer, including the electronic transportation layer which consists of an electronic transportation ingredient prepared in contact with said electron hole transportation zone, and the electronic injection layer formed in contact with said cathode.

[Claim 5] The light emitting device characterized by the energy difference of the highest occupied molecular orbital level and minimum sky molecular orbital level in said electron hole transportation ingredient being larger than the energy difference of the highest occupied molecular orbital level and minimum sky molecular orbital level in said electronic transportation ingredient in a light emitting device given in any 1 term of claim 1 thru/or claim 4.

[Claim 6] The light emitting device characterized by the absorption spectrum of said electron hole transportation ingredient and the emission spectrum of said electronic transportation ingredient not lapping in a light emitting device given in any 1 term of claim 1 thru/or claim 4.

[Claim 7] The light emitting device characterized by locating the absorption spectrum of said electron hole transportation ingredient in a short wavelength side rather than the emission spectrum of said electronic transportation ingredient in a light emitting device given in any 1 term of claim 1 thru/or claim 4, without the absorption spectrum of said electron hole transportation ingredient and the emission spectrum of said electronic transportation ingredient

lapping.

[Claim 8] The light emitting device to which both highest occupied molecular orbital level of said luminescent material and minimum sky molecular orbital level are characterized by being located in the energy gap of the highest occupied molecular orbital level and minimum sky molecular orbital level in said electronic transportation ingredient in a light emitting device given in any 1 term of claim 1 thru/or claim 7.

[Claim 9] The light emitting device to which the value of the ionization potential of said electron hole transportation ingredient is characterized by being the same compared with the value of the ionization potential of said luminescent material, or being large in a light emitting device given in any 1 term of claim 1 thru/or claim 8.

[Claim 10] The light emitting device characterized by the absolute value of the value which shows minimum sky molecular orbital level of said electron hole transportation ingredient being smaller than the absolute value of the value which shows minimum sky molecular orbital level of an electronic transportation ingredient 0.2eV or more in a light emitting device given in any 1 term of claim 1 thru/or claim 8.

[Claim 11] The light emitting device characterized by the value of the ionization potential of said electron hole transportation ingredient being the same as any 1 term of claim 1 thru/or claim 8 in the light emitting device of a publication compared with the value of the ionization potential of said luminescent material, being large, and the absolute value of the value which shows minimum sky molecular orbital level of said electron hole transportation ingredient being smaller than the absolute value of the value which shows minimum sky molecular orbital level of an electronic transportation ingredient 0.2eV or more.

[Claim 12] In a light emitting device given in any 1 term of claim 1 thru/or claim 11 Into said electron hole transportation ingredient, 4, 4', a 4"-tris (N-carbazole) triphenylamine, 4 and 4'-screw [N and N-bis(3-methylphenyl)-amino]-diphenylmethane, 1, 3, 5-tris [N and N-bis(2-methylphenyl)-amino]-benzene, 1, 3, 5-tris [N and N-bis(3-methylphenyl)-amino]-benzene Light emitting device characterized by using either of 1, 3, and 5-tris [N and N-bis(4-methylphenyl)-amino]-benzene.

[Claim 13] In a light emitting device given in any 1 term of claim 1 thru/or claim 12 They are 2, 2', and 2"-(1, 3, 5-benzene Trier) tris to said electronic transportation ingredient. - [1-phenyl-1H-benzimidazole], a lithium tetrapod (2-(2-hydroxyphenyl) benzoOKISAZORATO boron --) Bis(2-(2-hydroxyphenyl) benzoOKISAZORATO) (triphenyl SHIRANORATO) aluminum, Bis(2-(2-hydroxyphenyl) benzothia ZORATO) (triphenyl SHIRANORATO) aluminum, 2-(2-hydroxyphenyl) benzoOKISAZORA tritium, (2-(2-hydroxyphenyl) benzoOKISAZORATO)-diphenyl boron, Tris (8-quinolinolato)-aluminum, bis(2-methyl-8-quinolinolato) (triphenyl SHIRANORATO) aluminum, Bis(2-methyl-8-quinolinolato) (4-phenyl phenolate) aluminum, The light emitting device characterized by using lithium tetrapod (2-methyl-8-hydroxy-kino RINATO)

boron, (2-methyl-8-quinolinolato)-diphenyl boron, or bis(2-methyl-8-quinolinolato) aluminum hydroxide.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] the organic compound film with which, as for this invention, luminescence will be obtained if an anode plate and electric field are added, and cathode -- since -- it is related with the organic light emitting device constituted. It is related with the organic light emitting device for which the luminescent material which presents luminescence from a triplet excitation state especially was used.
[0002]
[Description of the Prior Art] An organic light emitting device is a light emitting device using luminescence from the molecule (excited molecule) of the excitation state which the electron and the electron hole were poured into the organic compound film by impression of an electrical potential difference from two electrodes, and was formed of those recombination.
[0003] The energy emitted in case an excited molecule is formed and luminescence from the organic compound film deactivates in a ground state serves as light. In this deactivation process, it may deactivate via the case (fluorescence is emitted in this case) where it deactivates greatly via those with two kinds of another ****, and a singlet excited molecule, and a triplet excited molecule. Although there are a light emission process as phosphorescence and a triplet-triplet dissipating stage in the deactivation process via a triplet excited molecule, there are few organic materials which step on the deactivation process via phosphorescence at a room temperature fundamentally (what carries out thermal inactivation does not perform deactivation by light emission by most). For this reason, most organic compounds used for an

organic light emitting device are the ingredients which emit the fluorescence via a singlet excited molecule, and luminescence of many organic light emitting devices uses fluorescence.
[0004] The bilayer mold structure which sandwiched with the electrode the organic compound film of sum total about 100 nm extent which carried out the laminating of two kinds of organic compounds where C.W.Tang etc. reported the organic light emitting device using the organic compound which emits this fluorescence in 1987 has been to the base (nonpatent literature 1 reference). Three-layer mold structure was proposed by Adachi etc. after that in 1988 (nonpatent literature 2 reference), and the component structure of a multilayer mold where such laminating mold structures were applied is taken in current.
[0005]
[Nonpatent literature 1] C.W. Tang and S.A.Vanslyke, "Organic electroluminescent diodes", Applied Physics Letters, Vol.51, No.12, 913-915 [(1987) nonpatent literature 2] Chihaya ADACHI, Shozuo TOKITO, Tetsuo TSUTSUI and Shogo SAITO, "Electroluminescence in Organic Films with Three-Layered Structure", Japanese Journal of Applied Physics, Vol.27, No.2, L269-L271(1988) [0006] The component of such multilayer mold structure has the description of "functional separation of a layer." Functional separation of a layer is a thing of making a function share for every layer rather than giving various functions at coincidence to one kind of organic compound. For example, in the component of bilayer mold structure, the electron hole transportation layer which plays a role of transportation of an electron hole, and the luminescent electronic transportation layer which plays transportation of an electron and a role of luminescence are used, and the electron hole transportation layer which plays a role only of electron hole transportation, the electronic transportation layer which plays a role only of electronic transportation, and the luminous layer which emits light between the bilayer are used with the component of three-layer mold structure. Thus, the advantage that a degree of freedom increases is in the molecular design of the organic compound used for an organic light emitting device by carrying out functional separation of each class.
[0007] For example, with the component of monolayer mold structure, it is easy to inject an electron and an electron hole into one layer, and has the function to convey both carriers, and many properties that a fluorescence quantum yield is also high are searched for. However, when an electronic transportability luminous layer is used like the component of bilayer mold structure, that what is necessary is just to apply the organic compound which obtains a high fluorescence quantum yield that the organic compound which is easy to pour in an electron hole tends to be poured into an electron by the electronic transportability luminous layer to an electron hole transportation layer, respectively, the demand to one layer decreases and it becomes easy to choose an ingredient.
[0008] Moreover, with the component of three-layer mold structure, the function of the electronic transportability and the luminescence in introducing a "luminous layer" further is

separable. And by using for a luminous layer what distributed fluorochromes (guest) of a high quantum yield, such as laser coloring matter, into the solid-state medium (host) ingredient, the fluorescence quantum yield of a luminous layer can be raised and luminescence wavelength can be freely controlled by selection of the fluorochrome the quantum efficiency of an organic light emitting device not only improves greatly, but used (nonpatent literature 3 reference). Thus, the component which distributed coloring matter (guest) into the host ingredient is called a dope mold component.

[0009]

[Nonpatent literature 3] C.W. Tang, S.A.Vanslyke and C.H.Chen, "Electroluminescence of doped organic thin films", Journal of Applied Physics, Vol.65, 3610-3616 [(1989)0010] Another effective point of the component of multilayer mold structure is a "carrier locked-in effect." For example, in the case of the bilayer mold structure of nonpatent literature 1, an electron hole is poured in from an anode plate in an electron hole transportation layer, an electron is poured in from cathode in an electronic transportation layer, and it moves to the interface of an electron hole transportation layer and an electronic transportation layer. To being poured in after that, in an electronic transportation layer, since the difference of an electron hole of the ionization potential of an electron hole transportation layer and an electronic transportation layer is small, since the difference of an electron of an electron affinity with an electronic transportation layer is too large to the top where the electroaffinity of an electron hole transportation layer is small, it is not injected into an electron hole transportation layer, but is blocked by the electron hole transportation layer, and is shut up into an electronic transportation layer. Therefore, the consistency of both an electron hole and an electron becomes high within an electronic transportation layer, and recombination of a carrier comes to be performed efficiently.

[0011] The very large ingredient of ionization potential is mentioned as an example of an ingredient effective in demonstrating such a carrier locked-in effect. It is difficult to pour an electron hole into an ingredient with large ionization potential, and such an ingredient is broadly used as an ingredient (electron hole blocking ingredient) which can block an electron hole. For example, when the laminating of the electronic transportation layer which consists of an electron hole transportation layer which consists of an aromatic series diamine compound reported with nonpatent literature 1, and tris (8-quinolinolato)-aluminum (it is described as "Alq" below) is carried out, if an electrical potential difference is impressed to this, Alq of an electronic transportation layer will emit light. However, an electron hole is shut up by the electron hole transportation layer by inserting an electron hole blocking ingredient between the bilayers of this component, and an electron hole transportation layer side can also be made to emit light.

[0012] Thus, by introducing layers (an electron hole transportation layer, an electron hole blocking layer, an electronic transportation layer, electronic injection layer, etc.) with various

functions, control of efficient-izing and the luminescent color etc. was attained and multilayer mold structure was established as basic structure in the current organic light emitting device.
[0013] Under these circumstances, the dope mold component (it is described as a "triplet light emitting device" below) which used as a guest the triplet luminescent material (metal complex which uses platinum as a central metal by reference) which can obtain luminescence (phosphorescence) from a triplet excitation state at a room temperature by S.R.Forrest and others was announced in 1998 (nonpatent literature 4 reference). In addition, below, in order to distinguish from this triplet light emitting device, the component using luminescence from a singlet excitation state is described as a "singlet light emitting device."
[0014]
[Nonpatent literature 4] M.A. Baldo, D.F.O'Brien, Y.You, A.Shoustilkov, S.Silbley, M.A.Thomoson and S.R.Forrest, "Highly efficient phosphorescent emission from organic electroluminescent devices", Nature, Vol.395, 151-154 [(1998)0015] Although stated even in the top, there are a singlet excited molecule and a triplet excited molecule as excited molecule generated by the recombination of the electron hole and electron which were poured into the organic compound. In this case, it originates in the difference in the multiplicity of spin, and a singlet excited molecule and a triplet excited molecule generate at a rate of 1:3. With an old ingredient, fundamentally, in order that a triplet excited molecule may carry out thermal inactivation in a room temperature, only a singlet excited molecule is used for luminescence. For this reason, only the quadrant of the generated excited molecule is used for luminescence. If a triplet excited molecule can use for luminescence here, about three to 4 times of former can obtain high luminescence of effectiveness.
[0016] The multilayer mold structure described previously is used in nonpatent literature 4. Namely, the compound 4 of an aromatic amine system and a 4'-screw [N-(1-naphthyl)-N-phenylamino]-biphenyl (it is described as "alpha-NPD" below) are used as an electron hole transportation layer. The thing which made Alq distribute 2, 3, 7, 8, 12, 13, 17, 18-OKUTA ethyl-21H, and 23H-porphyrin-platinum (for it to be described as "PtOEP" below) 6% as a luminous layer is used. The value which the maximum of external quantum efficiency calls 4% with the component structure using Alq as an electronic transportation layer, and calls 1.3 % by 100 cd/m2 was shown.
[0017] With the component structure using an electron hole blocking layer, as an electron hole transportation layer then, alpha-NPD 4, 4'-N, and the thing that made the N'-dicarbazole-biphenyl (it is described as "CBP" below) distribute PtOEP 6% as a luminous layer As an electron hole blocking layer, 2, the 9-dimethyl -4, 7-diphenyl -1, and 10-phenanthroline (it is described as "BCP" below) Alq is used as an electronic transportation layer and it is at 100 cd/m2. 5.6 % and the luminous efficiency of a component are raised by external-quantum-efficiency 2.2 % and max (nonpatent literature 5 reference).

[0018]
[Nonpatent literature 5] D. -- F.O'Brien, M.A.Baldo, M.E.Thompson and S.R.Forrest, and "Improvedenergy transfer in electrophosphorescent devices" -- Applied Physics Letters, Vol.74, No.3, and 442-444 [(1999) 0019 --] the triplet light emitting device which furthermore used tris (2-phenyl pyridine) iridium (it is described as "Ir (ppy)3" below) as a triplet luminescent material is reported (nonpatent literature 6 reference), and it is called external-quantum-efficiency 14.9 % by 100 cd/m2 by optimizing the thickness of the organic compound film with the component structure same after that as nonpatent literature 6 -- the efficient organic light emitting device is also reported very much (nonpatent literature 7 reference). The component which obtains one about 3 times the luminous efficiency of the conventional singlet light emitting device of this came to be produced now as a matter of fact.
[0020]
[Nonpatent literature 6] M.A. Baldo, S.Lamansky, P.E.Burrows, M.E.Thompson and S.R.Forrest, and "Very high-efficiency green organic light-emitting devices based on electrophosphoresce nce" -- Applied Physics Letters, Vol.75, No.1, and 4-6 -- [(1999) nonpatent literature 7] Teruichi Watanabe, Kenji Nakamura, Shin Kawami, Yoshinori Fukuda, Taishi Tsuji, Takeo Wakimoto, Satoshi Miyaguchi, Masayuki Yahiro, Moon-Jae Yang, Tetsuo Tsutsui, "Optimization of emittimg efficiency in organic LED cells using Ir complex", SyntheticMetals, Vol.122, 203-207 [(2001)0021] It is searched for the triplet luminescent material which used iridium and platinum for current and a central metal, the very efficient triplet light emitting device is capturing the spotlight compared with the singlet light emitting device, and research is performed energetically.
[0022] Although a triplet light emitting device is far high luminous efficiency compared with a singlet light emitting device, compared with a singlet light emitting device, a life is extraordinarily short, and stability is missing. Moreover, although multilayer structure is taken in order to gather effectiveness therefore, also at the lowest, component structure is 4 layer structures, and there is also a simple demerit of taking time and effort to component production.
[0023] The electron hole transportation layer which used alpha-NPD about the life of a component, and the luminous layer which used Ir (ppy)3 which is CBP and the guest (dopant) ingredient which are a host ingredient, In the component which carried out the laminating of the electron hole blocking layer which used BCP, and the electronic transportation layer which used Alq, there is a report (nonpatent literature 8 reference) of only 170 hours in a half-life on the conditions of initial brightness 500 cd/m2, and it is far from utilization from this life.
[0024]
[Nonpatent literature 8] Tetsuo TSUTSUI, Moon-Jae YANG, Masayuki YAHIRO, Kenji-NAKAMURA,Teruichi WATANABE, Taishi TSUJI, Yoshinori FUKUDA, Takeo WAKIMOTO-

and-Satoshi MIYAGUCHI, "High Quantum Efficiency-inorganic Light-Emitting-Devices with-Iridium-Complex as-a-Triplet-Emissive Center", Japanese Journalof Applied Physics, Vol.38, No.12B, L1502-L1504 [(1999)0025] With nonpatent literature 8, it is mentioned as this cause that the stability of BCP currently used with the electron hole blocking ingredient is low. In the triplet light emitting device, the component structure shown with nonpatent literature 5 is basic structure, and the electron hole blocking layer is used as an indispensable thing. The structure of the conventional triplet light emitting device is shown in drawing 12 . It has the component structure where carry out an anode plate 1102 on a substrate 1101, and the laminating of the electron hole transportation layer 1103, a luminous layer 1104, the electron hole blocking layer 1105, the electronic transportation layer 1106, and the cathode 1107 was carried out as organic compound film on it. Although recombination of a carrier comes to be efficiently performed by the locked-in effect of the carrier by the electron hole blocking layer, since the electron hole blocking ingredient currently generally used has the fault that stability is low, on the other hand, a life is not prolonged. Moreover, since CBP currently used as a host ingredient is also an ingredient with low stability, this is also considered to be one of the causes that a life is not prolonged.

[0026] The component of the three-layer mold structure which does not use an electron hole blocking layer is also produced (nonpatent literature 9 reference). Here, it is characterized by using with an electronic transportation ingredient instead of CBP said to be both carrier transportability as a host ingredient. However, the electronic transportation ingredient used for the host ingredient BCP, 1, 3-screw (N, N-t-butyl-phenyl) which are used as an electron hole blocking ingredient - 1, 3, 4-oxazole (it is described as "OXD7" below), 3-phenyl-4-(1'-naphthyl)-5-phenyl - It is 1, 2, and 4-triazole (it is described as "TAZ" below), and although an electron hole blocking layer is not introduced, what is well used as an electron hole blocking ingredient after all is used in a component. Of course in addition to this, the ingredient of BCP of a throat is also a low ingredient of stability, and although it comes out of high effectiveness, it is a component with low stability.

[0027]

[Nonpatent literature 9] Chihaya ADACHI, Marc A. Baldo, Stephen R. Forrest-and-Mark-E. Thompson, "High-efficiency organic-electrophosphorescent devices with-tris(2-phinylpyridine) iridium-doped-into-electron-transporting materials", Applied Physics Letters, Vol.77,No.6, 904-906 [(2000)0028] moreover, the component structure of the simple bilayer mold which does not use an electron hole blocking ingredient is also reported -- **** (nonpatent literature 10 reference) -- CBP is used for a host ingredient, and stability is missing although high luminous efficiency has been acquired.

[0029]

[Nonpatent literature 10] Chihaya ADACHI, Raymond KWONG, Stephen R.Forrest, "Efficient

electrophosphorescence using a doped ambipolar conductive molecular organicthin film", Organic Electronics, Vol.2, and 37-43 [(2001) 0030 --]

[Problem(s) to be Solved by the Invention] Thus, although the component with high luminous efficiency is reported in the triplet light emitting device, there is still no report of the triplet light emitting device that it is efficient and stable, and the instability of the host ingredient currently used as the cause and an electron hole blocking ingredient has become a cause.

[0031] So, by this invention, without using an ingredient unstable in this way, by simplifying component structure, are efficient and let it be a technical problem to offer the triplet light emitting device which can save time and effort in component production compared with the conventional component moreover it is stable.

[0032]

[Means for Solving the Problem] In a triplet light emitting device, the electron hole blocking layer introduced by the conventional triplet light emitting device is not used for this invention, but the organic compound film is attained by making an electron hole transportation layer and the layer which distributed the dopant ingredient which carries out triplet luminescence into the stable electronic transportation ingredient into the simple component structure (drawing 1) which carried out the laminating. That is, it is attained with the component structure to which the laminating of the electronic transportability luminous layer 104 which consists of an anode plate 102, the electron hole transportation layer 103 which consists of an electron hole transportation ingredient on it, an electronic transportation ingredient, and a dopant ingredient which carries out triplet luminescence on a substrate 101, and the cathode 105 was carried out. Here, the field (namely, the electron hole transportation layer 103 and the electronic transportability luminous layer 104) inserted into an anode plate 102 and cathode 105 is equivalent to the organic compound film.

[0033] therefore -- this invention -- an anode plate, the organic compound film, and cathode -- since -- in the organic light emitting device constituted, said organic compound film is characterized by to be added the luminescent material which presents luminescence from a triplet excitation state in said electronic transportation layer, including the electron hole transportation layer which consists of an electron hole transportation ingredient, and the electronic transportation layer which consists of an electronic transportation ingredient prepared in contact with said electron hole transportation layer.

[0034] In addition, a hole injection layer may be inserted between an anode plate 102 and the electron hole transportation layer 103. Moreover, an electronic injection layer may be inserted between cathode 105 and the electronic transportability luminous layer 104. Furthermore, both these hole injection layers and an electronic injection layer may be inserted.

[0035] By the way, in the above components, in order to prevent the electron hole transportation layer 103 emitting light, it is also important as The means for solving a technical

problem to take into consideration the combination of an electron hole transportation ingredient and an electronic transportation ingredient.

[0036] So, in this invention, the energy difference of the highest occupied molecular orbital level and minimum sky molecular orbital level in said electron hole transportation ingredient is characterized by being larger than the energy difference of the highest occupied molecular orbital level and minimum sky molecular orbital level in said electronic transportation ingredient.

[0037] Moreover, it is characterized by the absorption spectrum of said electron hole transportation ingredient and the emission spectrum of said electronic transportation ingredient not lapping as other means. In this case, it is desirable a spectrum not only does not simply lap, but that the absorption spectrum of said electron hole transportation ingredient is located in a short wavelength side rather than the emission spectrum of said electronic transportation ingredient as spectral-position relation.

[0038] In order to raise the luminous efficiency of the triplet light emitting device of this invention which was described above here, the dopant which carries out triplet luminescence is important also for making a carrier the component configuration which is easy to carry out a trap as The means for solving a technical problem.

[0039] So, in this invention, both highest occupied molecular orbital level of luminescent material and minimum sky molecular orbital level that present luminescence from a triplet excitation state are characterized by being located in the energy gap of the highest occupied molecular orbital level and minimum sky molecular orbital level in said electronic transportation ingredient.

[0040] Moreover, it is characterized by the value of the ionization potential of said electron hole transportation ingredient being the same compared with the value of the ionization potential of the luminescent material which presents luminescence from a triplet excitation state, or being large as other means.

[0041] It is characterized by the absolute value of the value which shows minimum sky molecular orbital level of said electron hole transportation ingredient being smaller than the absolute value of the value which shows minimum sky molecular orbital level of said electronic transportation ingredient more than 0.2 eV as a means of further others.

[0042] In addition, compared with the value of the ionization potential of the component configuration which combined these, i.e., the luminescent material which the value of the ionization potential of said electron hole transportation ingredient presents luminescence from a triplet excitation state, it is the same, or is large, and the absolute value of the value which shows minimum sky molecular orbital level of said electron hole transportation ingredient can say that the case of being small is more desirable more than 0.2 eV rather than the absolute value of the value which shows minimum sky molecular orbital level of said electronic

transportation ingredient.
[0043] The above-mentioned thing is taken into consideration. As a suitable electron hole transportation ingredient for this invention 4, 4', a 4"-tris (N-carbazole) triphenylamine, 4 and 4'-screw [N and N-bis(3-methylphenyl)-amino]-diphenylmethane, 1, 3, 5-tris [N and N-bis(2-methylphenyl)-amino]-benzene, 1, 3, 5-tris [N and N-bis(3-methylphenyl)-amino]-benzene It is characterized by using either of 1, 3, and 5-tris [N and N-bis(4-methylphenyl)-amino]-benzene.
[0044] Moreover, they are 2, 2', and 2"-(1, 3, 5-benzene Trier) tris to said electronic transportation ingredient. - [1-phenyl-1H-benzimidazole], a lithium tetrapod (2-(2-hydroxyphenyl) benzoOKISAZORATO boron --) Bis(2-(2-hydroxyphenyl) benzoOKISAZORATO) (triphenyl SHIRANORATO) aluminum, Bis(2-(2-hydroxyphenyl) benzothia ZORATO) (triphenyl SHIRANORATO) aluminum, 2-(2-hydroxyphenyl) benzoOKISAZORA tritium, (2-(2-hydroxyphenyl) benzoOKISAZORATO)-diphenyl boron, Tris (8-quinolinolato)-aluminum, bis(2-methyl-8-quinolinolato) (triphenyl SHIRANORATO) aluminum, Bis(2-methyl-8-quinolinolato) (4-phenyl phenolate) aluminum, It is characterized by using lithium tetrapod (2-methyl-8-hydroxy-kino RINATO) boron, (2-methyl-8-quinolinolato)-diphenyl boron, or bis(2-methyl-8-quinolinolato) aluminum hydroxide.
[0045] In the component of this invention, it is still more effective to use it combining these electron hole transportation ingredients and an electronic transportation ingredient.
[0046]
[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained to a detail. In addition, although it is good if either an anode plate or the cathode of the organic light emitting device is transparent at least in order to take out luminescence, with the gestalt of this example, it forms a transparent anode plate on a substrate, and describes the component structure which takes out light from an anode plate side. In practice, it is applicable also to the structure which forms cathode on a substrate and takes out light from cathode, and the structure which takes out light from a reverse side with a substrate and the structure which takes out light from the both sides of an electrode.
[0047] As mentioned above, in this invention, it is characterized by not using an electron hole blocking layer in a triplet light emitting device (drawing 1). However, it does not become that what is necessary is just to produce the component except an electron hole blocking layer from the conventional component structure (drawing 12) simply.
[0048] First, with the conventional triplet light emitting device and the component of the bilayer mold of this invention, a difference is in a recombination field. From using an electron hole blocking layer in the conventional triplet light emitting device, the recombination field of a carrier was the interface of a luminous layer and an electron hole blocking layer. On the other hand, with the component structure proposed by this invention, the recombination field of a carrier becomes the interface of an electron hole transportation layer and the electronic

transportation ingredient which is a host.

[0049] For this reason, the luminescent mechanism of a triplet light emitting device is important. Two kinds of luminescent mechanism can be considered as luminescent mechanism of the component which used the luminous layer of the host-guest system which generally used the dopant (guest).

[0050] The first luminescent mechanism is luminescence of the dopant by the energy transfer from a host. In this case, first, both carriers are poured into a host and a host's excited molecule is formed. The energy of this excited molecule moves to a dopant, a dopant is excited by that energy, and light is emitted in case it deactivates. Since a dopant is an ingredient which emits phosphorescence via a triplet excited molecule in the case of a triplet light emitting device, the light which emitted light is phosphorescence.

[0051] It becomes important that the overlap of the emission spectrum of a host ingredient and the absorption spectrum of a dopant ingredient is large at the luminescent mechanism by energy transfer. The physical relationship of the highest occupied molecular orbital (HOMO) in a host ingredient and a dopant ingredient and a minimum sky molecular orbital (LUMO) is not important.

[0052] In addition, it sets on these specifications and the value of HOMO uses the value of the ionization potential observed by photoelectron spectroscopy measurement in atmospheric air. Moreover, the absorption end of an absorption spectrum is made into the energy difference (this energy difference is hereafter described as an "energy gap value") of HOMO and LUMO. Therefore, what lengthened the energy gap value estimated by the absorption end of an absorption spectrum from the value of the ionization potential measured by photoelectron spectroscopy measurement is being used for the value of LUMO. here, in fact, although a negative value is taken since these values (HOMO (ionization potential), LUMO, energy gap value) are based on vacuum level, suppose that all are expressed with this detail in the letter in an absolute value. If the conceptual diagram of HOMO, LUMO, and an energy gap value is expressed, it will become like drawing 2 .

[0053] By the way, when both the energy level of HOMO of a dopant ingredient and LUMO is located in the energy gap of HOMO and LUMO in a host ingredient, the luminescent mechanism of the direct recombination that in addition to the luminescent mechanism of the energy transfer from the host who stated previously to a dopant the trap of the carrier is carried out on a dopant, and a direct carrier is recombined on a dopant is also produced. This is the second luminescent mechanism.

[0054] However, since it has been the conditions which also start energy transfer when a dopant ingredient and a host ingredient are in the physical relationship of such energy level, it is usually difficult to separate whether luminescent mechanism is contribution from which device, and possibility that both luminescent mechanism is involving is also considered.

[0055] First, the case where the triplet light emitting device is emitting light by the device (the first luminescent mechanism) of energy transfer is considered. With the conventional component structure, since the recombination field of a carrier is the interface of a luminous layer and an electron hole blocking layer, the energy transfer to an electron hole blocking ingredient is also considered besides the energy transfer from a host ingredient to a dopant ingredient. However, since the absorption spectrum of an electron hole blocking ingredient is in a short wavelength side very much, there is no part which the emission spectrum of a host ingredient and the absorption spectrum of an electron hole blocking ingredient which have been reported by the conventional triplet light emitting device overlap, and the energy transfer between host ingredient-electron hole blocking ingredients cannot happen. That is, in the triplet light emitting device of a conventional type, it can be said that it has the component structure where energy transfer does not happen from a host ingredient to an electron hole blocking ingredient.

[0056] On the other hand, with the component structure in this invention, the recombination field of a carrier is the interface of the electron hole transportation layer containing an electron hole transportation ingredient, and the electronic transportability luminous layer containing a host ingredient. For this reason, with the component of this invention, the energy transfer from a host ingredient to an electron hole transportation ingredient can be considered. Efficient luminescence cannot be obtained if energy transfer starts from a host ingredient to an electron hole transportation ingredient.

[0057] Then, the size relation between the energy gap value of a host ingredient and the energy gap value of an electron hole transportation ingredient serves as a rough standard about energy transfer. If the energy gap value of a host ingredient is smaller than the energy gap value of an electron hole transportation ingredient, it is difficult to excite an electron hole transportation ingredient by the energy transfer from a host ingredient. In order to make it energy transfer not happen from the host ingredient from this to an electron hole transportation ingredient, an electron hole transportation ingredient has a desirable thing with a larger energy gap value than a host ingredient.

[0058] Drawing 3 is an energy diagram in this case. As shown in drawing 3 , the energy gap value A of an electron hole transportation ingredient should just choose an ingredient so that it may become larger than the energy gap value B of a host ingredient.

[0059] Moreover, there is also the technique of choosing the combination of an ingredient which does not have overlap in the emission spectrum of a host ingredient and the absorption spectrum of an electron hole transportation ingredient as conditions from which energy transfer does not arise between host ingredient-electron hole transportation ingredients. Under the present circumstances, as for the absorption spectrum of an electron hole transportation ingredient, being located in a short wavelength side is more desirable than the emission

spectrum of an electronic transportation ingredient.

[0060] This condition is illustrated to drawing 4 . (a) shows spectral-position relation in case (b) does not cause energy transfer for spectral-position relation in case energy transfer happens between host ingredient-electron hole transportation ingredients between host ingredient-electron hole transportation ingredients, respectively. It is desirable that it is in the physical relationship of (b) in this invention.

[0061] Since the luminescent mechanism (the second luminescent mechanism) of direct recombination is also taken into consideration when both the energy level of HOMO of a dopant ingredient and LUMO chooses a host ingredient which is located in HOMO of a host ingredient, and the energy gap of LUMO in addition to these conditions, it is important to take the further conditions into consideration.

[0062] In this case, what has the large value of the ionization potential which shows HOMO of an electron hole transportation ingredient is suitable so that an electron hole carrier may be easy to be poured in to a dopant ingredient from an electron hole transportation ingredient. That is, it combines so that the ionization potential of an electron hole transportation ingredient may become large from the ionization potential of a dopant ingredient. Although an electron hole will consist is hard to be poured into an electron hole transportation ingredient of an anode plate if the ionization potential of an electron hole transportation ingredient is too large, it is improved by introducing a hole injection layer between an anode plate and an electron hole transportation layer in this case.

[0063] Moreover, to an electronic carrier, it is thought that a dopant carries out the trap of the electronic carrier through the host of electronic transportability. If the LUMO level and great difference of a host ingredient do not have the LUMO level of an electron hole transportation ingredient when the electron by which a trap was not carried out to a dopant moves in the inside of an electronic transportation layer and arrives to an interface with an electron hole transportation layer, the electron which arrived at the interface will enter to an electron hole transportation layer. For this reason, an electron is not confined in an electronic transportation layer and efficient recombination is not performed. In order to avoid such a situation, it is expected to be sufficiently large that the difference of the LUMO level of an electron hole transportation ingredient and the electronic transportation ingredient which is a host ingredient blocks an electron. A certain thing of this difference is desirable more than 0.2 eV.

[0064] Next, it illustrates more concretely about the producing method and the ingredient to be used of a triplet light emitting device of this invention.

[0065] The component production approach of this invention shown in drawing 1 vapor-deposits an electron hole transportation ingredient first to the substrate which has an anode plate (ITO), then carries out vapor codeposition of an electronic transportation ingredient (host ingredient) and the triplet luminescent material (dopant ingredient), and, finally forms cathode

by vacuum evaporationo. The dopant concentration at the time of carrying out vapor codeposition of a host ingredient and the dopant ingredient is united so that it may become about abbreviation 8wt%. Finally the closure is performed and an organic light emitting device is obtained.

[0066] Next, the suitable ingredients for the hole-injection ingredient which can be used with the component of this invention, an electron hole transportation ingredient, electronic transportation material (host ingredient), and triplet luminescent material (dopant ingredient) are enumerated below. However, the ingredient used for the component of this invention is not limited to these.

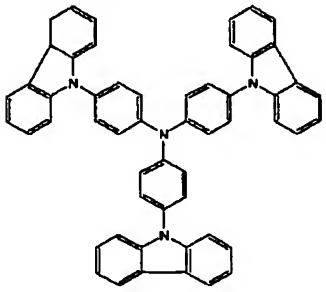
[0067] As a hole-injection ingredient, the compound of a **** porphyrin system, a phthalocyanine (it is described as "H2Pc" below), a copper phthalocyanine (it is described as "CuPc" below), etc. are effective at an organic compound. Moreover, if it is the ingredient which the value of ionization potential is small and has an electron hole transportation function rather than the electron hole transportation ingredient to be used, this can also be used as a hole-injection ingredient. The ingredient which performed chemistry doping is also in a conductive polymer compound, and the polyethylene dioxythiophene (it is described as "PEDOT" below) which doped polystyrene sulfonate (it is described as "PSS" below), the poly aniline, etc. are mentioned. Moreover, the high molecular compound of an insulator is also effective in respect of flattening of an anode plate, and polyimide (it is described as "PI" below) is used well. Furthermore, an inorganic compound is also used and there is a super-thin film of an aluminum oxide (it is described as an "alumina" below) besides metal thin films, such as gold and platinum, etc.

[0068] The thing with the larger energy gap value as an electron hole transportation ingredient than the energy gap value of the electronic transportation ingredient used as a host ingredient is effective. Moreover, ionization potential is larger than luminescent material, or it is more desirable than an electronic transportation ingredient that the absolute value of LUMO is small more than 0.2 eV.

[0069] As an electron hole transportation ingredient with the suitable large energy gap value for the component of this invention 4 and 4' which are expressed with the following structure expression (1), a 4"-tris (N-carbazole) triphenylamine (it is described as "TCTA" below), 1 expressed with the following structure expression (2), 3, 5-tris [N and N-bis(2-methylphenyl)-amino]-benzene (it is described as "o-MTDAB" below), 1 expressed with following structure expression (3), 3, and 5-tris [N and N-bis(3-methylphenyl)-amino]-benzene (it is described as "m-MTDAB" below) 1 expressed with the following structure expression (4), 3, 5-tris [N and N-bis(4-methylphenyl)-amino]-benzene (it is described as "p-MTDAB" below), The 4 and 4'-screw [N and N-bis(3-methylphenyl)-amino]-diphenylmethane (it is described as "BPPM" below) expressed with the following structure expression (5) is mentioned.

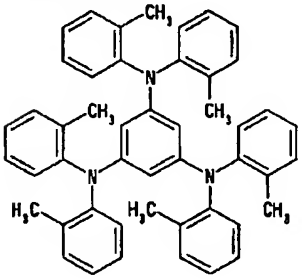
[0070]

[Formula 1]



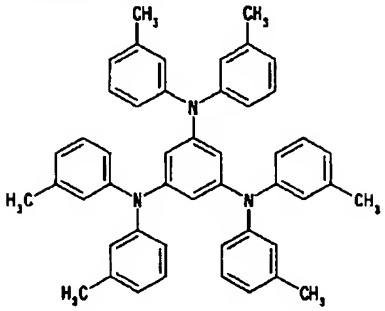
(1)

[Formula 2]



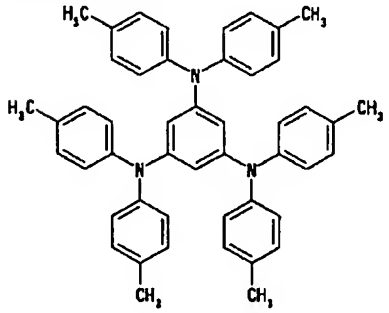
(2)

[Formula 3]



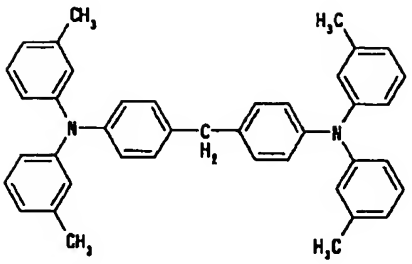
(3)

[Formula 4]



(4)

[Formula 5]



(5)

[0071] The 4-4'-screw [N-(3-methylphenyl)-N-phenylamino]-biphenyl (it is described as "TPD" below) which is the compound of an aromatic amine system used on the other hand most widely, alpha-NPD which is the derivative have a small energy gap value compared with the compound of structure-expression (1) - (5), and the use to the component of this invention is difficult for it. Structure expression (1) If the energy gap value (actual measurement) of the compound of - (5), alpha-NPD, and TPD is summarized, it will become as it is shown in Table 1.

[0072]

[Table 1]

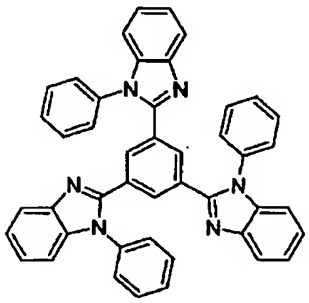
材料名	エネルギーギャップ値 [eV]
TCTA	3.3
o-MTDAB	3.6
m-MTDAB	3.5
p-MTDAB	3.6
BPPM	3.6
TPD	3.1
α-NPD	3.1

[0073] Next, as an electronic transportation ingredient which serves as a host, what has high stability is desirable, and many extremely stable metal complexes are raised. A host ingredient must be an ingredient with a larger energy gap value than the triplet luminescent material which is a dopant. Such a host ingredient changes with luminescent material to be used. In the component of this invention, the example of an electronic transportation ingredient usable as a host is shown below.

[0074] this invention -- setting -- blue -- luminescent material -- receiving -- a host -- an ingredient -- ****** -- it can be used -- the matter -- the following -- a structure expression -- (-- six --) -- expressing -- having -- two -- two -- ' -- two -- " - (1, 3, 5-benzene tolyl) -- tris - the matter like an ultraviolet region with which an emission spectrum is looked at very much by short wavelength [1-phenyl-1H-benzimidazole] (it is described as "TPBI" below) is mentioned.

[0075]

[Formula 6]

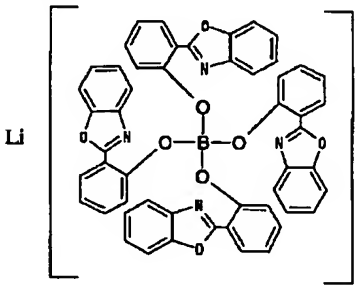


(6)

[0076] In this invention, as a host ingredient to green luminescent material the lithium tetrapod (2-(2-hydroxyphenyl) benzoOKISAZORATO boron (it is described as "LiB (PBO)4" below) --) expressed with the following structure expression (7) The bis(2-(2-hydroxyphenyl) benzoOKISAZORATO) (triphenyl SHIRANORATO) aluminum expressed with the following structure expression (8) (it is described as "SAlo" below), The bis(2-(2-hydroxyphenyl) benzothia ZORATO) (triphenyl SHIRANORATO) aluminum expressed with the following structure expression (9) (it is described as "SAlt" below), 2-(2-hydroxyphenyl) benzoOKISAZORA tritium expressed with the following structure expression (10) (it is described as "Li (PBO)" below), - diphenyl boron (it is described as "B(PBO) Ph2" below) expressed with the following structure expression (11) (2-(2-hydroxyphenyl) benzoOKISAZORATO) is mentioned. Use of the ingredient which can carry out blue luminescence in addition to these is also possible.

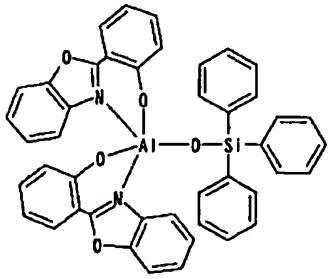
[0077]

[Formula 7]



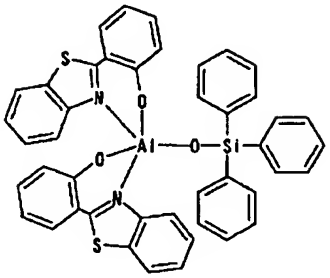
(7)

[Formula 8]



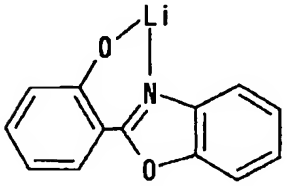
(8)

[Formula 9]



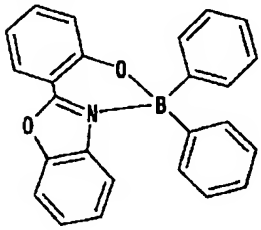
(9)

[Formula 10]



(10)

[Formula 11]

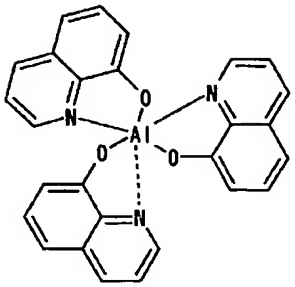


(11)

[0078] In this invention, as a host ingredient to red luminescent material Alq expressed with the following structure expression (12), the bis(2-methyl-8-quinolinolato) (triphenyl SHIRANORATO) aluminum expressed with the following structure expression (13) (it is described as "SAlq" below), The bis(2-methyl-8-quinolinolato) (4-phenyl phenolate) aluminum expressed with the following structure expression (14) (it is described as "BAlq" below), The lithium tetrapod (2-methyl-8-hydroxy-kino RINATO) boron expressed with the following structure expression (15) (it is described as "LiB (mq)4" below), - diphenyl boron expressed with the following structure expression (16) (2-methyl-8-quinolinolato) (it is described as "BmqPh" below), The bis(2-methyl-8-quinolinolato) aluminum hydroxide (it is described as "Almq2 (OH)" below) expressed with the following structure expression (17) is mentioned. The ingredient which can carry out blue luminescence in addition to these, and the ingredient which can carry out green luminescence are also usable as host ingredients.

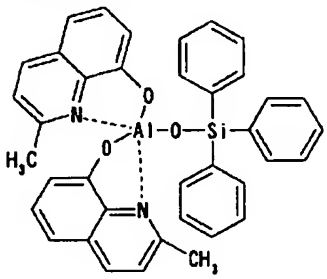
[0079]

[Formula 12]



(12)

[Formula 13]



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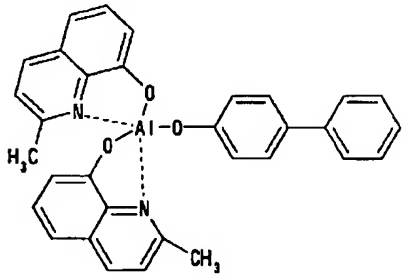
[Formula 14]



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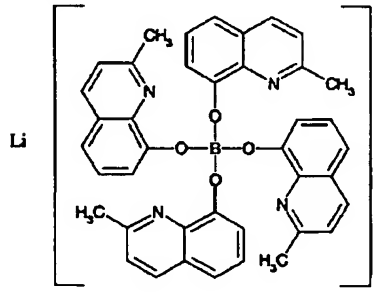
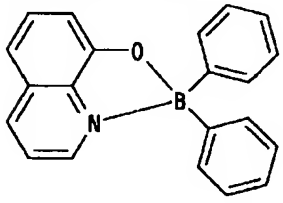
[Formula 15]



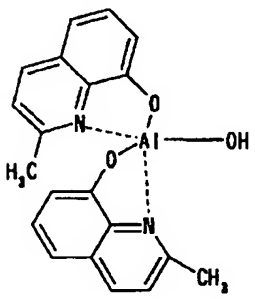
(15)

[Formula 16]



(16)

[Formula 17]



(17)

[0080] In addition, the energy gap value (actual measurement) about some of the host ingredients described here becomes as it is shown in Table 2.

[0081]

[Table 2]

材料名	エネルギーギャップ値 [eV]
TPBI	3.5
$LiB(PBO)_4$	3.1
SAlo	3.2
SAlt	3.0
Alq	2.7
SAlq	3.0
$LiB(mq)_4$	3.0

[0082] Although many complexes which use iridium or platinum as a central metal are raised as a triplet luminescent material which is a dopant, what is necessary is just the ingredient which emits phosphorescence at a room temperature. PtOEP, Ir(ppy) 3 and bis(2-phenyl pilus JINATO-N, C2') acetylacetonate iridium (it is described as "acaclr (ppy)2" below), Bis(2-(4'-tolyl) pilus JINATO-N, C2') acetylacetonate iridium (it is described as "acaclr (tpy)2" below), Bis (2 -(2'-benzothienyl)- pilus JINATO-N, C3') acetylacetonate iridium (it is described as "acaclr (btp)2" below) etc. is mentioned.

[0083] In addition, the energy gap value (actual measurement) of the dopant ingredient described here becomes as it is shown in Table 3.

[0084]

[Table 3]

材料名	エネルギーギャップ値 [eV]
$Ir(ppy)_3$	2.4
$acaclr(ppy)_2$	2.4
$acaclr(tpy)_2$	2.4
$acaclr(btp)_2$	2.3

[0085] As an electron injection ingredient, the electronic transportation ingredient described in the top can be used. However, since electronic transportation ingredients (BCP, OXD7, etc.) which are used as an electron hole blocking ingredient have low stability, they are unsuitable. In addition, a super-thin film of an insulator like alkali-metal oxides, such as alkali-metal halogenides, such as lithium fluoride, and lithium oxide, is used well. Moreover, lithium acetylacetonate (it is described as "Li (acac)" below) and alkali-metal complexes, such as a 8-quinolinolato-lithium (it is described as "Liq" below), are also effective.

[0086] By combining respectively the ingredient which has each function which was described above, and applying it to the organic light emitting device of this invention, in a production process, time and effort can be saved upwards rather than the conventional triplet light emitting device, it is extremely stable and the efficient organic light emitting device of same extent as the conventional triplet light emitting device can be produced efficiently.
[0087]
[Example] In this example, the organic light emitting device shown in drawing 2 of this invention is illustrated concretely.
[0088] [Example 1] ITO which is an anode plate 102 carries out 40 nm vacuum evaporationo of the BPPM which is an electron hole transportation ingredient first at the glass substrate 101 by which 100 nm extent membrane formation was carried out. This is the electron hole transportation layer 103.
[0089] After an electron hole transportation layer is produced, vapor codeposition is performed so that it may become about 2:23 ratio (weight ratio) about acaclr (tpy)2 which is triplet luminescent material, and TPBI which is an electronic transportation ingredient (host ingredient). That is, acaclr(tpy) 2 will be distributed by TPBI by about 8 wt% concentration. 50 nm membrane formation of this coevaporation membrane is carried out. This is the electronic transportability luminous layer 104.
[0090] Vapor codeposition is performed so that an atomic ratio may finally be set to 10:1 in Mg and Ag as cathode 105, and 150 nm membrane formation of the cathode is carried out. The triplet light emitting device of green luminescence which originates in acaclr (tpy)2 by this is obtained.
[0091] Drawing 5 is the graph of the initial property in this component, and an emission spectrum. The maximum external quantum efficiency indicated the component property of high effectiveness to be about 10 % also with the component structure of a simple bilayer mold.
[0092] An electron hole transportation ingredient (however, ingredient which fulfills the conditions of this invention) which is different in the [example 2] example 1 was used, and the component of this invention was produced.
[0093] First, ITO which is an anode plate 102 carries out 40 nm vacuum evaporationo of o-MTDAB which is an electron hole transportation ingredient at the glass substrate 101 by which 100 nm extent membrane formation was carried out. This is the electron hole transportation layer 103.
[0094] After an electron hole transportation layer is produced, vapor codeposition is performed so that it may become about 2:23 ratio (weight ratio) about acaclr (tpy)2 which is triplet luminescent material, and TPBI which is an electronic transportation ingredient (host ingredient). That is, acaclr(tpy) 2 will be distributed by TPBI by about 8 wt(s)% concentration. 50 nm membrane formation of this coevaporation membrane is carried out. This is the

electronic transportability luminous layer 104.

[0095] Vapor codeposition is performed so that an atomic ratio may finally be set to 10:1 in Mg and Ag as cathode 105, and 150 nm membrane formation of the cathode is carried out. The triplet light emitting device of green luminescence which originates in acaclr (tpy)2 by this is obtained.

[0096] Drawing 6 is the initial property of this light emitting device, and the graph of an emission spectrum. An efficient component is producible like an example 1.

[0097] An electronic transportation ingredient (however, ingredient which fulfills the conditions of this invention) which is different in the [example 3] example 1 was used as a host ingredient, and the organic light emitting device which this invention shows was produced. The production approach is the same approach as examples 1 and 2, and SAlt and a dopant are using acaclr (tpy) 2 for an electron hole transportation ingredient at the electronic transportation ingredient which are BPPM and a host. The triplet light emitting device of green luminescence originating in acaclr (tpy)2 can be obtained.

[0098] The initial property and emission spectrum of this component are shown in drawing 7 . It becomes the conventional triplet light emitting device and the efficient component of this this like examples 1 and 2.

[0099] Triplet luminescent material which is different in the [example 4] examples 1, 2, and 3 was used as a dopant, and the organic light emitting device from which the luminescent color differs was produced in examples 1, 2, and 3. The production approach is the same approach as examples 1, 2, and 3, and TPBI and a dopant are using bis(2-(2', 4'-difluoro phenyl) pilus JINATO-N, C2') PIKORATO iridium for an electron hole transportation ingredient at the electronic transportation ingredient which are BPPM and a host. The triplet light emitting device of blue luminescence originating in a dopant ingredient can be obtained.

[0100] The initial property and emission spectrum of this component are shown in drawing 8. It becomes the conventional triplet light emitting device and the efficient component of this this like examples 1, 2, and 3.

[0101] The example of the [example 1 of comparison] book comparison produced the conventional triplet light emitting device as shown in drawing 12 , and the component of the same structure, and compared the property in that case with the component of this invention.

[0102] First, ITO which is an anode plate 1102 carries out 40 nm vacuum evaporationo of alpha-NPD which is an electron hole transportation ingredient at the glass substrate 1101 by which 100 nm extent membrane formation was carried out. This is the electron hole transportation layer 1103.

[0103] After an electron hole transportation layer is produced, vapor codeposition is performed so that it may become about 2:23 ratio (weight ratio) about acaclr (tpy)2 which is triplet luminescent material, and CBP which is a host ingredient. That is, acaclr(tpy) 2 will be

distributed by CBP by about 8 wt(s)% concentration. 50 nm membrane formation of this coevaporation membrane is carried out. This is a luminous layer 1104.

[0104] After forming a luminous layer, 20 nm vacuum evaporationo of the BCP which is an electron hole blocking ingredient is carried out, and the electron hole blocking layer 1105 is formed. 30 nm vacuum evaporationo of the Alq which is an electronic transportation ingredient after that is carried out, and the electronic transportation layer 1106 is formed.

[0105] Vapor codeposition is performed so that an atomic ratio may finally be set to 10:1 in Mg and Ag as cathode 1107, and 150 nm membrane formation of the cathode is carried out. The triplet light emitting device of green luminescence which originates in acaclr (tpy)2 by this is obtained.

[0106] The initial property of this component and an emission spectrum are shown in drawing 9 . It turns out that the component of this invention shown in the example compared with examples 1, 2, and 3 is an efficient component of same extent as the component of a conventional type. Even if it did not use an electron hole blocking layer, it has checked that sufficient component property was shown.

[0107] In the example of the [example 2 of comparison] book comparison, the property of the triplet light emitting device of the bilayer mold structure which used an electron hole transportation ingredient which is not applied to the conditions of the component of this invention is illustrated.

[0108] Although the production approach is the same as that of an example, the combination of an electron hole transportation ingredient-host ingredient with which the energy gap value of the electron hole transportation ingredient to be used becomes small compared with a host ingredient is used. Into an electron hole transportation ingredient, acaclr (tpy)2 is used for TPBI and the dopant which are an electronic transportation ingredient at TPD and a host ingredient.

[0109] The initial property of this component and an emission spectrum are shown in drawing 10 . When TPD was used for the electron hole transportation ingredient, it became a component with very low effectiveness for a triplet light emitting device. Although it turns out that an emission spectrum is seen, the spectrum (near 400nm) which is luminescence from TPD is observed besides luminescence from acaclr (tpy)2. Effectiveness will become low owing to this. Thus, when the ingredient which is not applied to conditions is used, the initial property of a component is bad.

[0110] In the example of the [example 3 of comparison] book comparison, the property of the triplet light emitting device of the bilayer mold structure which used an electron hole transportation ingredient which is not applied to the conditions of the component of this invention like the example 2 of a comparison is illustrated.

[0111] Although the production approach is the same as that of an example, the combination

of an electron hole transportation ingredient-host ingredient with which the energy gap value of the electron hole transportation ingredient to be used becomes small compared with a host ingredient is used. Into an electron hole transportation ingredient, acaclr (tpy)2 is used for TPBI and the dopant which are an electronic transportation ingredient at alpha-NPD and a host ingredient.

[0112] The initial property of this component and an emission spectrum are shown in drawing 11 . When alpha-NPD was used for the electron hole transportation ingredient, the example 2 of a comparison became the same a component with very low effectiveness for a triplet light emitting device. An emission spectrum and the spectrum (near 440nm) which is luminescence from alpha-NPD which is an electron hole transportation ingredient like the example 2 of a comparison are observed. Effectiveness will become low owing to this. Thus, if the ingredient which is not applied to conditions is used, the initial property of a component will worsen.

[0113]

[Effect of the Invention] A triplet light emitting device with same extent efficient by carrying out this invention as the conventional triplet light emitting device can be obtained with a simple component configuration. Moreover, a stable organic light emitting device can be offered by excluding the layer which uses an unstable ingredient.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Drawing showing the component structure of the bilayer mold triplet light emitting device in this invention.

[Drawing 2] Drawing showing the energy level of HOMO-LUMO.

[Drawing 3] The energy gap diagram of a component.

[Drawing 4] Drawing showing the physical relationship of the emission spectrum of a host

ingredient, and the absorption spectrum of an electron hole transportation ingredient.
[Drawing 5] The initial property and emission spectrum of an example 1.
[Drawing 6] The initial property and emission spectrum of an example 2.
[Drawing 7] The initial property and emission spectrum of an example 3.
[Drawing 8] The initial property and emission spectrum of an example 4.
[Drawing 9] The initial property and emission spectrum of the example 1 of a comparison.
[Drawing 10] The initial property and emission spectrum of the example 2 of a comparison.
[Drawing 11] The initial property and emission spectrum of the example 3 of a comparison.
[Drawing 12] Drawing showing the component structure of the conventional triplet light emitting device.

[Translation done.]

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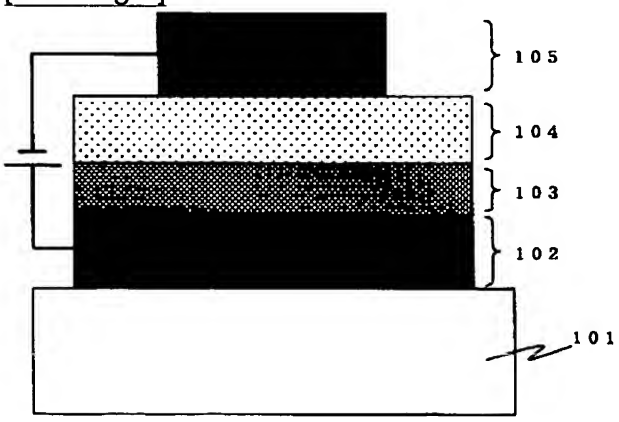
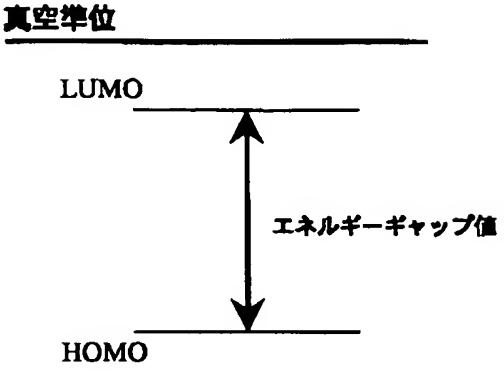
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

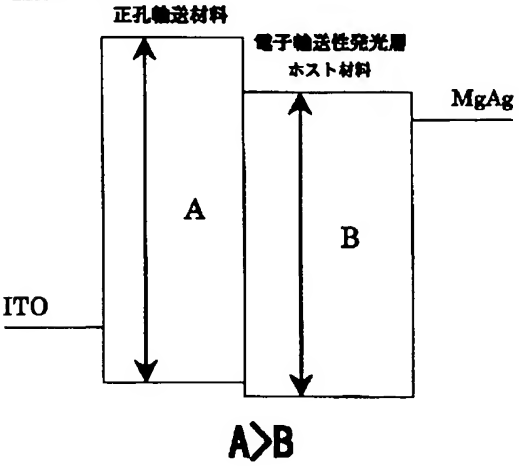
[Drawing 1]



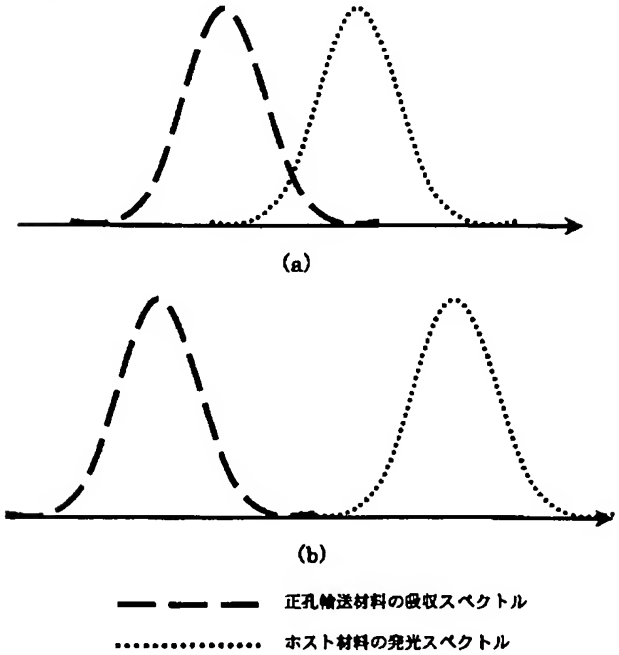
[Drawing 2]



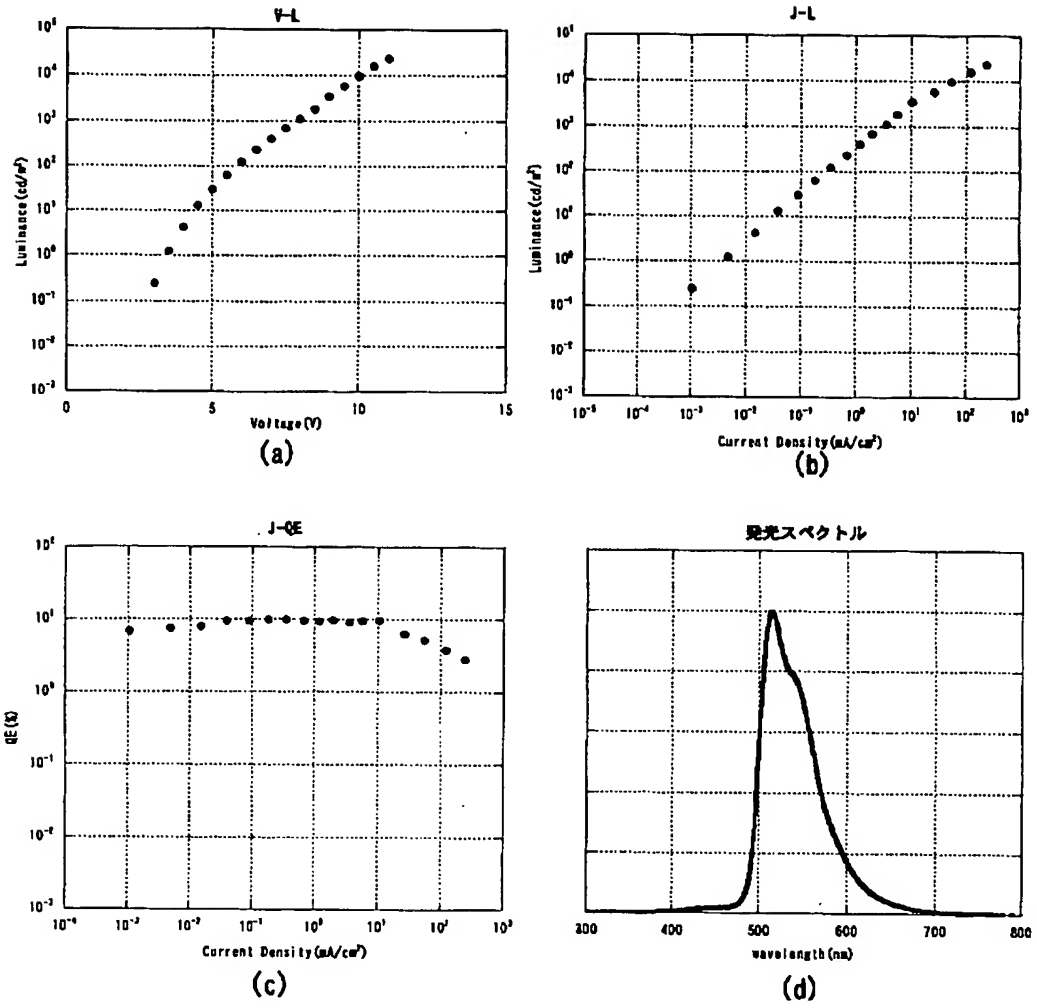
[Drawing 3]



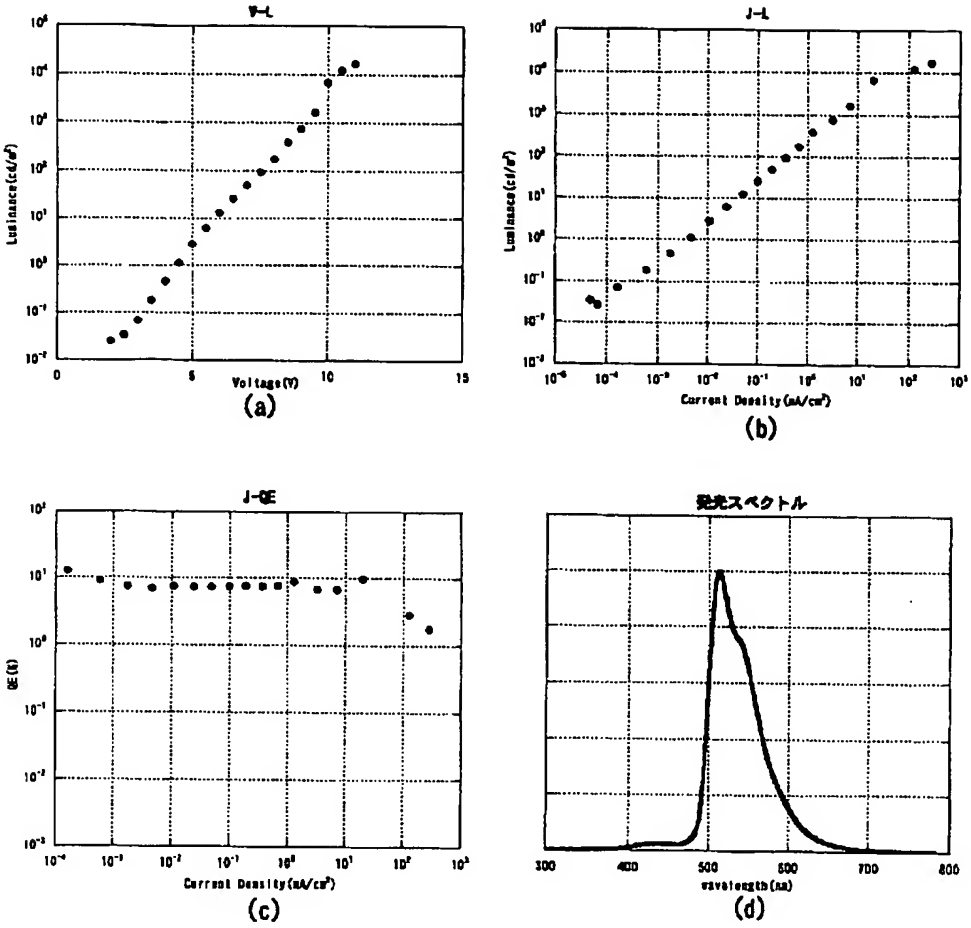
[Drawing 4]



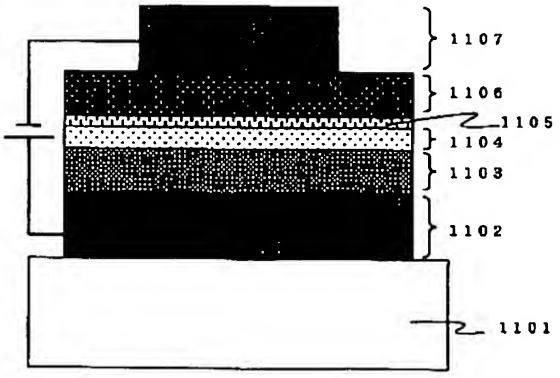
[Drawing 5]


V-L
Luminance(cd/m²)
Voltage(V)
(a)
J-L
Luminance(cd/m²)
Current Density(mA/cm²)
(b)
J-QE
QE(%)
Current Density(mA/cm²)
(c)
発光スペクトル
wavelength(nm)
(d)

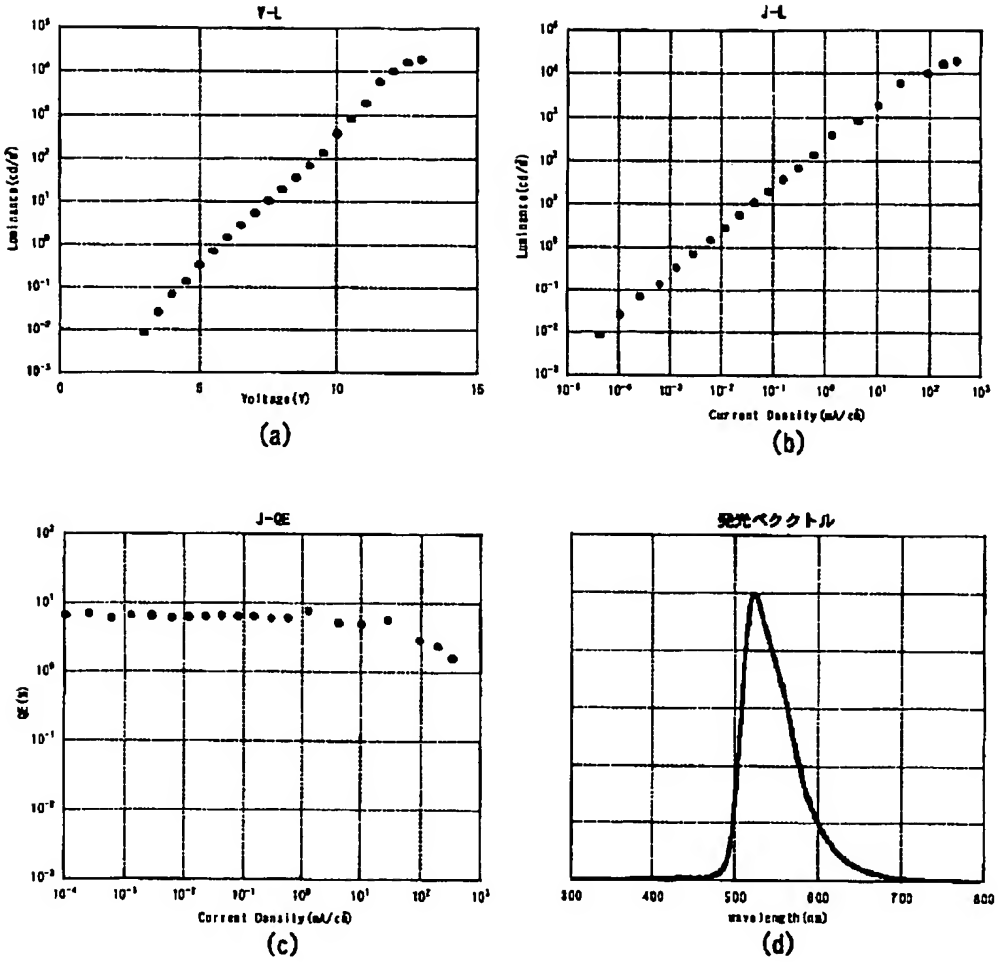
[Drawing 6]



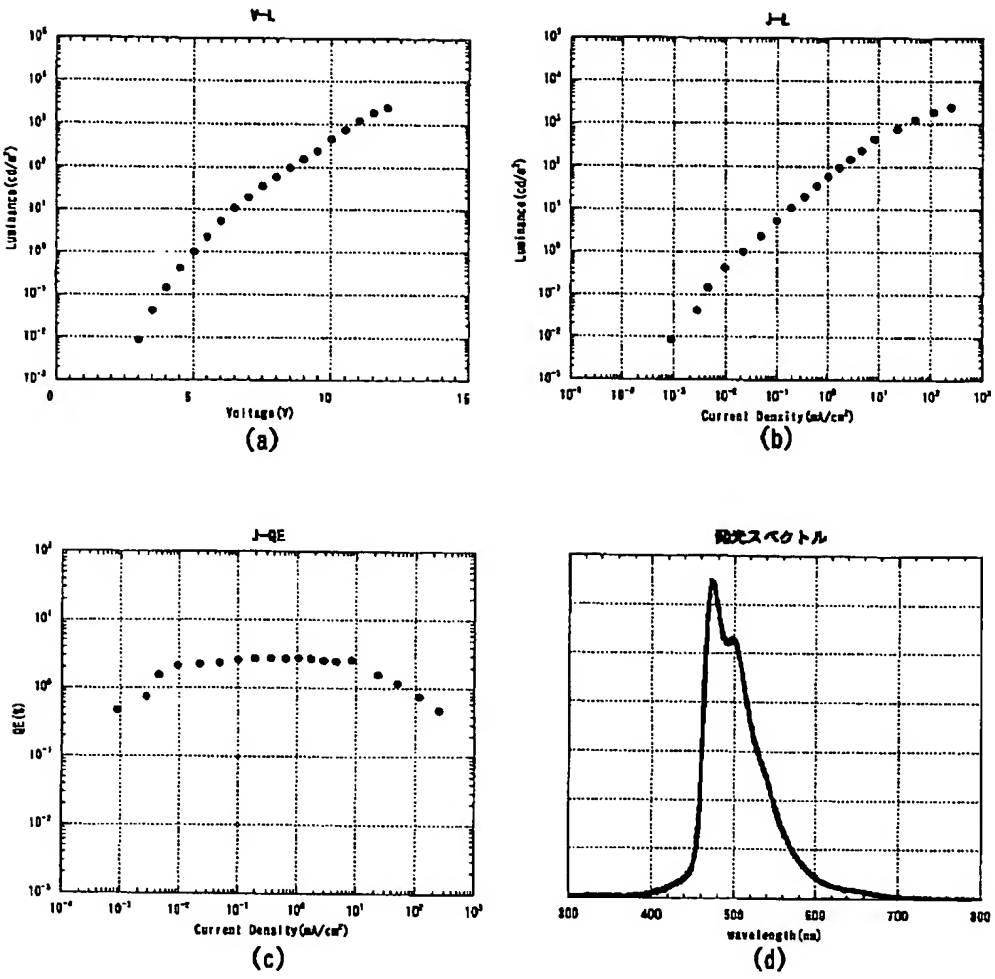
[Drawing 12]



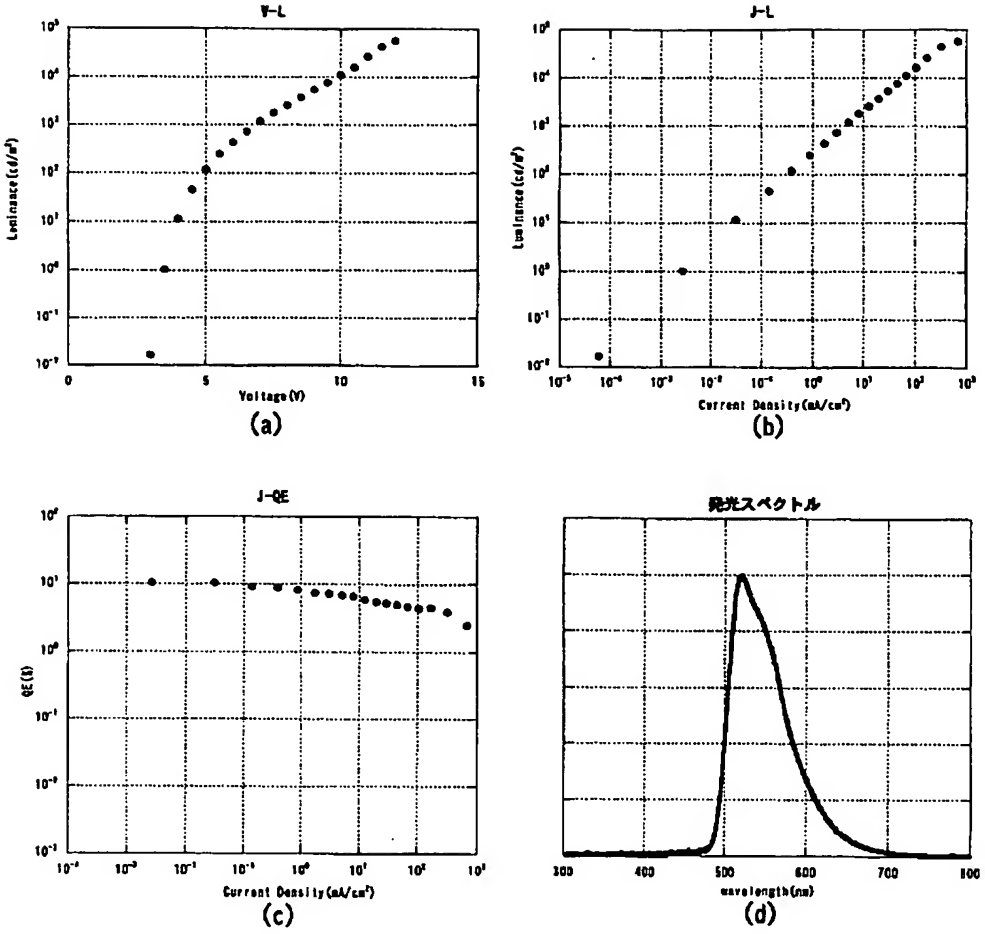
[Drawing 7]


V-L
Voltage(V)
(a)
J-L
Current Density(mA/cm²)
(b)
J-QE
Current Density(mA/cm²)
(c)
発光スペクトル
wavelength(nm)
(d)

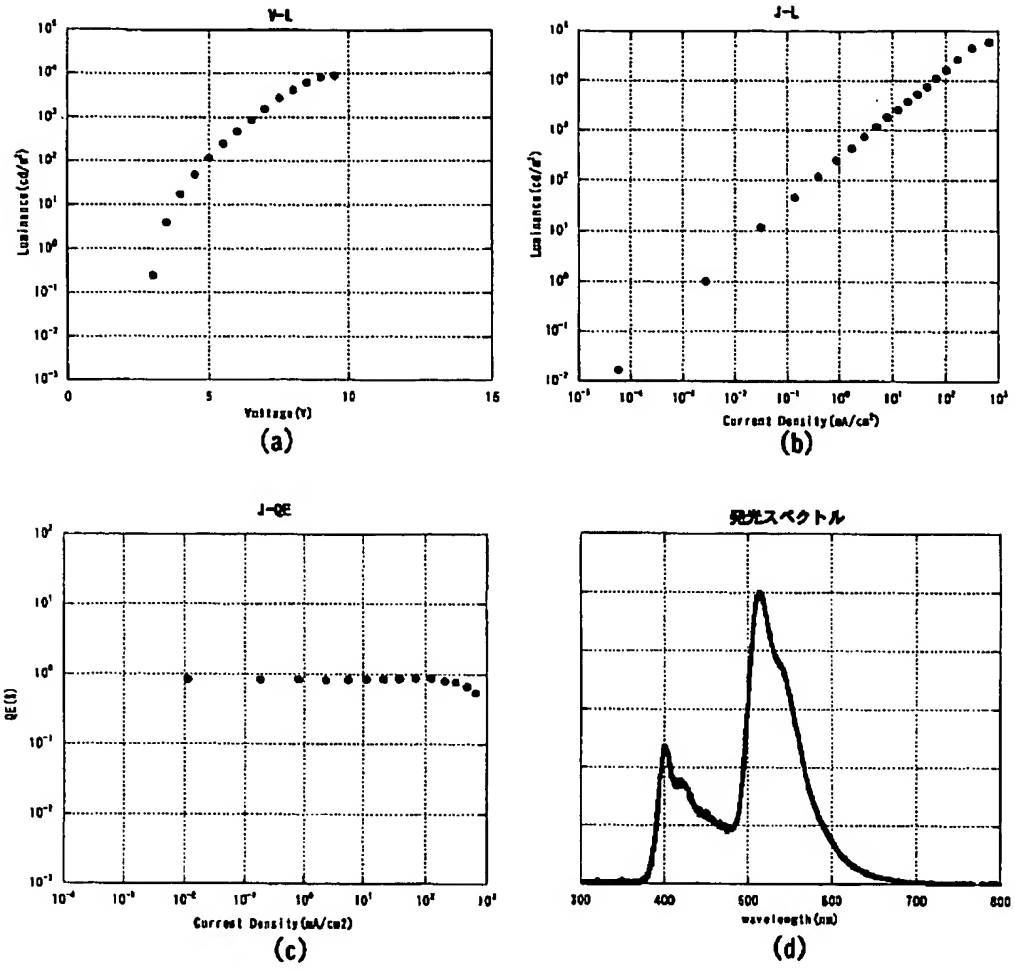
[Drawing 8]


V-L
Luminance(cd/m²)
Voltage(V)
(a)
J-L
Luminance(cd/m²)
Current Density(mA/cm²)
(b)
J-QE
QE(%)
Current Density(mA/cm²)
(c)
発光スペクトル
wavelength(nm)
(d)

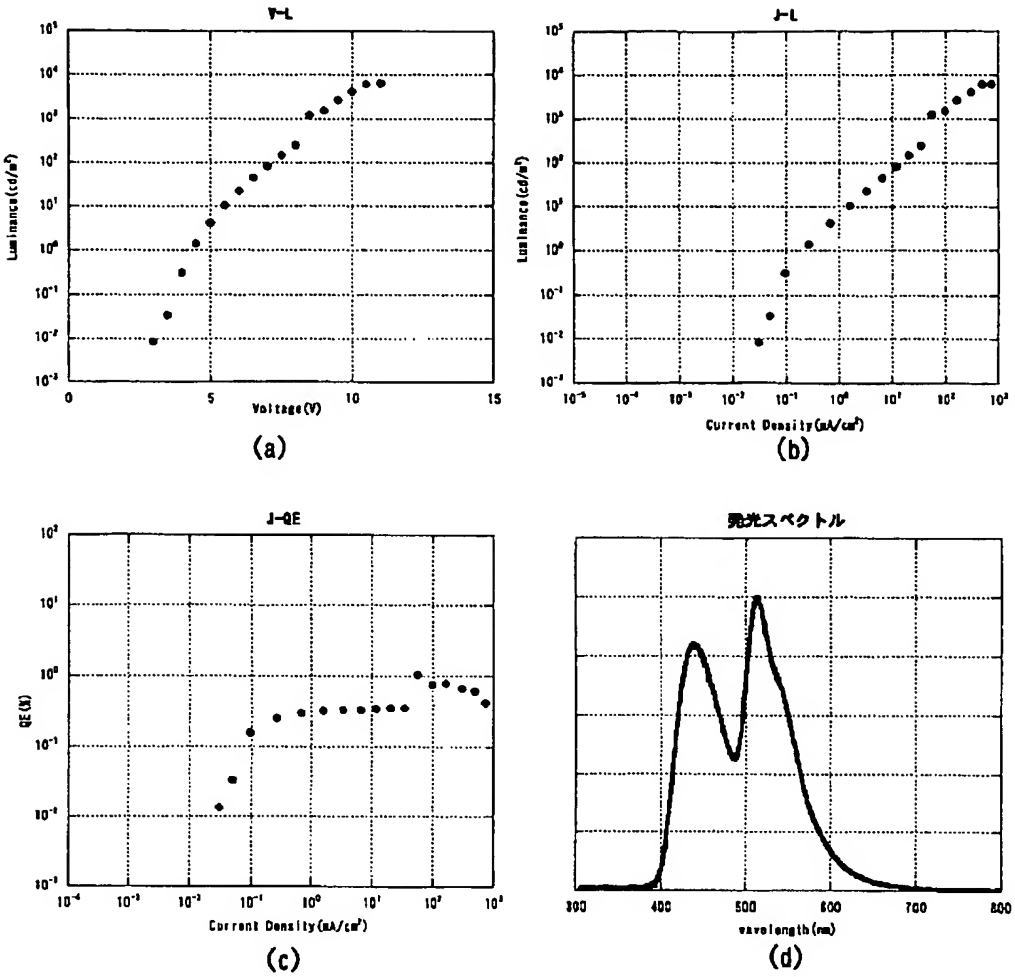
[Drawing 9]


V-L
Voltage(V)
(a)
J-L
Current Density(mA/cm²)
(b)
J-QE
Current Density(mA/cm²)
(c)
発光スペクトル
wavelength(nm)
(d)

[Drawing 10]


V-L
Luminance(cd/m²)
Voltage(V)
(a)
J-L
Luminance(cd/m²)
Current Density(mA/cm²)
(b)
J-QE
QE(%)
Current Density(mA/cm2)
(c)
発光スペクトル
wavelength(nm)
(d)

[Drawing 11]



[Translation done.]